



The Relationship between Anthropometrics and Performance among Collegiate Rodeo Athletes

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Abstract

Due to a limited number of informative articles available on collegiate rodeo and its athletes, this work aimed to examine the relationship between anthropometric measurements and the physical fitness of rodeo athletes to add to the limited literature focused on the physical profile of rodeo athletes. Within the protocol of university IRB guidelines, 14 (20.86 ± 1.17 years; 178.2 ± 7.85 cm; 86.48 ± 21.39 Kg) male rodeo athletes at a division I school located in the Southwest United States participated in two consecutive six-week resistance training programs. Anthropometric data and fitness performance data from each participating athlete were gathered. The following data were collected: body fat percentage, lean body mass (LBM), vertical jump height, T-test, 300-yard shuttle times, barbell back squat, bench press, trap bar deadlift one repetition maximums (1RMs), single-hand reaction time, and multi-hand reaction time. Research methods included exploratory analysis - including means and standard deviations - to enable a correlational analysis. Descriptive data analysis revealed that the trap bar deadlift 1RM had a significant relationship with the bench press 1RM ($r=0.874$, $p=0.005$) and back squat 1RM ($r=0.938$, $p=0.002$). Due to limited experience performing resistance training, 1RM performances were possibly based on increased neuromuscular efficiencies - i.e., a 'learning effect.' This study offers new and unique information about the modern rodeo athlete, which can help exercise science practitioners design more efficient training programs.

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INTRODUCTION

Armed with the century-strong knowledge from Spanish conquistadors and Spanish-Mexican settlers, range cowboys flourished in the post-civil war cattle industry boom. The era of the American Cowboy was born. As land was settled, range land was fenced off, and communities sprang up. Cowboys, infamous for their ever-competitive, adventure-seeking attributes, often competed against their counterparts from other outfits during town events (such as Fourth of July celebrations). These competitions soon became annual events and saw competitors joining Wild-West shows with the likes of Buffalo Bill (Dixon et al., 2023). By the 1890s, rodeo events became a popular spectator event, becoming officially organized as a sport in 1929. Thus, the rodeo was born and quickly became popular, with spectator attendance rivaling American baseball and auto racing (Meyers & Laurent, 2010).

Products of long work weeks, ceaseless heat, and often grievous working conditions, today's rodeo athletes are likely no different from a century ago. These athletes, necessarily so, are a resilient crowd notorious for their seeming inability to feel pain. Many injuries within this sport go unreported due to the athletes' behavior or pain threshold (Meyers & Laurent, 2010). Therefore, the staggering number of injury reports seen despite rodeo athletes' obstinate propensity depicts a critical issue within rodeo (Meyers & Laurent, 2010). These athletes face an 89% potential for injury each season, the most dangerous events being rough stock and steer wrestling (Meyers et al., 1992).

The sport itself, unique in its inclusion of unpredictable and uncontrollable animals, is characterized by intermittent bouts of high-intensity anaerobic activity. Rodeo activities are

segmented into rough stock and timed events. Roughstock events include saddle and bareback bronc riding and bull riding. Each of these activities requires the rider to stay atop the animal for as long as possible while adhering to strict rules; both the rider and the animal get scored based on their efforts to oppose the other, with the final score being a combination of the two. Timed events include steer wrestling, calf roping, team roping, and barrel racing. However, both can drastically affect the results of the event. Only the contestant (not the animal) gets scored in these activities (Hoye et al., 2019). With competitive times running from 2 to 25 seconds, rodeo events almost unanimously depend upon anaerobic energy pathways (Bogdanis et al., 1996) – a topic that will be further explored concerning athletic performance testing of the rodeo athlete in this study.

It is necessary to note that research has investigated almost every aspect of most major sports and the athletes that play them. This has led to a plethora of knowledge on athlete demographics, injury prevalence, and exercise protocol breakthroughs -- as well as their downfalls (Durocher et al., 2010; Faria et al., 2005; Kerr et al., 2016; Marinho et al., 2020). Equipped with this knowledge, experts in sports science have been able to create equipment, protective gear, and training protocols that have propelled today's athletes ever closer to peak performance (Bartsch et al., 2012; Kirkendall & Dvorak, 2010; McGuire, 2000). However, this scientifically-backed progression of the sport has not reached all levels of collegiate competition. Unfortunately for the rodeo athlete, the sports medicine knowledge and facilities conducive to the optimal performance for traditional sports over the years remain elusive for many in this sport (Meyers & Laurent, 2010).

While countless facets of information have been examined on sports such as football, cycling, and swimming, few studies have investigated collegiate rodeo. One of the said studies collected pre and post-test data on aerobic capacity, pulmonary ventilation, respiratory exchange ratio, energy expenditure, maximal heart rate, blood pressure, treadmill time, pre- and post-exercise lactate, percent body fat, lean body mass, blood chemistry, serum lipids, and reaction/movement time were analyzed by event (Meyers et al., 1992). While studies of this nature collect a large amount of data, they may not hold much functional purpose regarding rodeo athletes. This is because most rodeo events last for 30 seconds or less. As the body uses phosphocreatine almost solely for energy during the first 10-15 seconds of exercise (Bogdanis et al., 1996), most rodeo athletes do not significantly utilize aerobic metabolism during their events. Thus, the test of their aerobic endurance is irrelevant. In fact, from a functional standpoint, the only pertinent information gathered by studies in this line are reaction and movement time.

Earlier studies in this field have investigated the efficiency of recovery for shoulder and head injuries, the relationship between mood state and injury incidence, and psychological assessments of rodeo athletes (Meyers et al., 1992; Salvo, 2019; Wicklund et al., 2018). These works offer information on rodeo athletes' recovery, injury, and mental state, and their value is not to be dismissed. Notably, most publications on rodeo athletes are 10-30 years old and often authored by the same individuals. Further, relative to authorship, numerous scholars have participated in the publication of rodeo-based scholarship. Nevertheless, relatively few scholars have made research on rodeo athletes a focus in their careers. In fact, in reviewing the literature for the present study, one author [Meyer] appeared in more than fifteen studies investigating rodeo performance. This presents a potential challenge, as the values and perspectives of a small group of scholars have shaped the majority of rodeo-performance research, which might have limited the kind of questions asked, topics investigated, and methods used. Additionally, while these works offer beneficial knowledge, nearly all fail to effectively illustrate the physical profile of the rodeo athlete.

One work that defied this norm is perhaps the most thorough and practical of all previous rodeo documents. This composition described the sports science for rodeo, the history behind the sport, and what is currently known about the physical and physiological status, coronary risk profile, strength, and power levels, event-specific kinesiological and biomechanical aspects, nutritional habits and psychological indices associated with the rodeo athlete, in great detail (Cohn, 2013). As such, this study accomplished what few have done before and effectively illustrated the rodeo athlete in terms of human movement science by conducting a thorough review of more than 130 previous publications. Therein lies a notable shortcoming, however, of this groundbreaking work. As it was created as a review of literature, this study did not investigate its subjects in a scientific environment. Therefore, there is still a significant lack of qualitative information on modern rodeo athletes. This

study attempts to alter that fact by qualitatively observing a populace of rodeo athletes undergoing a resistance exercise training program.

A significant amount of information is available on nearly every major sport, such as injury prevalence and athlete demographics. However, there is a significant lack of information on the modern rodeo athlete (Meyers & Laurent, 2010). As such, there is limited information regarding the relationship between athlete anthropometrics and performance in collegiate rodeo athletes. The study aimed to bridge the gap in information on collegiate rodeo athletes by examining the relationship between anthropometrics and performance variables.

METHOD

Athletes were recruited verbally at the annual rodeo team meeting, and volunteer participants reported to the university Kinetic Performance Laboratory on their assigned testing days/times. Participants were 14 (20.86 ± 1.17 years; 178.2 ± 7.85 cm; 86.48 ± 21.39 Kg) male university rodeo athletes who volunteered for this study and participated in two consecutive six-week resistance training programs.

The importance of resistance training (Kelly & Pennington, 2021) and anaerobic power (Pennington, 2014; Pennington & Kinesiology, 2015) cannot be overstated for individuals in power- and speed-related sports contexts (Buske & Pennington, 2022). The following represents the performance-based resistance and training protocol employed by the participants of this study. A practicing Doctor of Physical Therapy with a return-to-sport specialization reviewed, analyzed, and approved this protocol. Ultimately, this training program was deemed appropriate for developing and improving anaerobic power and skeletal, and muscular strength, which would, in turn, improve the likelihood of athletes maintaining physical conditioning in-season and mitigate instances of injury (impact injuries notwithstanding – i.e., injuries specific to the unpredictability of rodeo animals).

Day 1					
w k1	w k2	w k3	w k4	w k5	w k6
BASE I	LOAD	LOAD	LOAD	LOAD	DELOAD
Neuro Prep - LATERAL					
A1 - Single Leg Isometric Squat w / MB Anti ROT.					
2x6ea	2x8ea	3x6ea	3x8ea	3x10ea	2x10ea
A2 - SL Depth Jump with Lat. Leap					
2x6ea	2x6ea	3x4ea	3x5ea	3x6ea	2x6ea
A3 - Copenhagen Side Plank					
2x6ea	2x8ea	3x8ea	3x8ea	3x10ea	2x10ea
PRIMARY BLOCK					
B1 - Back Squat					
10 @50%	10 @50%	10 @50%	10 @50%	10 @50%	10 @50%
6@75%	6@75%	6@75%	6@75%	6@75%	6@75%
AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%
Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP
B2 - Corrective Exercise					
2x8	3x8	3x10	2x10	3x12	4x10
PRIMARY BLOCK					
C1 - Goblet Lateral Lunge (Slides)					
2x8	3x8	3x10	2x10	3x12	4x10
C2 - Inverted Row					
2x8	3x8	3x10	2x10	3x12	4x10
C3 - 1 Arm Farmers Walk					
2x20yds	3x20yds	3x25yds	2x20yds	3x30yds	4x25yds
C4 - Corrective Exercise					
2x8	3x8	3x10	2x10	3x12	4x10

Day 2					
w k1	w k2	w k3	w k4	w k5	w k6
BASE I	LOAD	LOAD	LOAD	LOAD	DELOAD
Neuro Prep - Linear					
A1 - Bosuball Isometric Squat w / MB Anti ROT.					
2x6ea	2x8ea	3x6ea	3x8ea	3x10ea	2x10ea
A2 - Depth Drop to Broad Jump					
2x5	2x6	3x4	3x5	3x6	2x6
A3 - Hanging Leg Raise					
2x8	2x10	3x8	3x8	3x10	2x10
PRIMARY BLOCK					
B1 - Bench Press					
10 @50%	10 @50%	10 @50%	10 @50%	10 @50%	10 @50%
6@75%	6@75%	6@75%	6@75%	6@75%	6@75%
AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%
Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP
B2 - KB RDL					
2x8	3x8	3x10	2x10	3x12	4x10
PRIMARY BLOCK					
B2 - KB RDL					
2x8	3x8	3x10	2x10	3x12	4x10
C1 - Landmine Press					
2x8	3x8	3x10	2x10	3x12	4x10
C2 - Hamstring slides					
2x8	3x8	3x10	2x10	3x12	4x10
C3 - Corrective Exercise					
2x8	3x8	3x10	2x10	3x12	4x10

Day 3					
w k1	w k2	w k3	w k4	w k5	w k6
BASE I	LOAD	LOAD	LOAD	LOAD	DELOAD
Neuro Prep - Linear					
A1 - Tik Tak Sw oop Pass					
2x6ea	2x6ea	3x4ea	3x5ea	3x6ea	2x6ea
A2 - Hanging Leg Raise w / Rot.					
2x8	2x10	3x8	3x8	3x10	2x10
A3 - High Pull					
2x5	2x6	3x6	3x5	3x4	3x4
PRIMARY &BLOCK					
B1 - TrapBar Deadlift					
10 @50%	10 @50%	10 @50%	10 @50%	10 @50%	10 @50%
6@75%	6@75%	6@75%	6@75%	6@75%	6@75%
AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%	AMRAP @85%
Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP	Adj AMRAP
B2 - Corrective Exercise					
2x8	3x8	3x10	2x10	3x12	4x10
PRIMARY &BLOCK					
C1 - KB Swing (Banded)					
2x8	3x8	3x10	2x10	3x12	4x10
C2 - Single Arm Band Pulldown/Alt Pull Up					
2x8	3x8	3x10	2x10	3x12	4x10
C3 - OH MB Toss to Sprint					
2x20yds	3x20yds	3x25yds	2x20yds	3x30yds	4x25yds
C4 - Corrective Exercise					
2x8	3x8	3x10	2x10	3x12	4x10

Continued progression through this protocol with modifications to resistance includes potential improved running speed, explosive power potential, and other anaerobic sport performance factors, as well as enhanced neuromuscular efficiency associated with increased prime mover force production capabilities (Conley & Pennington, 2022). Each athlete performed the 300-yard shuttle test outdoors on the grass field, a vertical jump assessment using a Vertec (Sports Imports, Columbus, OH), and an agility T-test on an indoor court with timing by two technicians holding stopwatches. A three-site skinfold analysis determined body fat percentage (%BF) and fat-free mass (FFM). To determine the relationships among certain anthropomorphic variables, athlete data was gathered and included the following: body fat percentage, lean body mass (LBM), vertical jump height, T-test, 300-yard shuttle times, barbell back squat, bench press, trap bar deadlift one repetition maximums (1RMs), and single- and multi-hand reaction times. Using experimental methods, the authors' investigative approach included an exploratory analysis of the performance above variables, including means and standard deviations, to enable a correlational analysis.

RESULTS AND DISCUSSION

Results

Data included for the description of rodeo athletes are reported below. Male athletes had a body weight of $190.66 > 146$ lbs., lean body mass ($160.31 > 113.06$ lbs.), and 1RMs in the barbell back squat, bench press, trap bar deadlift ($259.88 > 138.35$ lbs.; $198.3 > 88.92$ lbs.; $343.78 > 168.96$ lbs.), vertical jumps of $22.75 > 14.95$ inches, and sprint test performances of $12.24 > 13.04$ s; $72.8 > 79.2$ s. As only 14 male athletes were included in this study (with only 2-3 participating in each event), male rodeo athlete data were not separated by event type.

Table 1. Performance Variables Descriptive Data

Body Weight (lbs.)	Lean Body Mass (lbs.)	Barbell Squat 1RM (lbs.)	Barbell Bench Press 1RM (lbs.)	Trap Bar Deadlift 1RM (lbs.)	Vertical Jump (in.)	T-test (sec.)	300-yard Shuttle (sec.)
190.66 > 146	$160.31 > 113.06$	$259.88 > 138.35$	$198.3 > 88.92$	$343.78 > 168.96$	$22.75 > 14.95$	$12.24 > 13.04$	$72.8 > 79.2$

Inferential statistics revealed that the trap bar deadlift 1RM had a significant relationship with the bench press 1RM ($r=0.874$, $p=0.005$) and back squat 1RM ($r=0.938$, $p=0.002$). Interestingly, the variable with the most correlational relationships was the 300-yard shuttle. Results show that the 300-yard shuttle had a significant relationship with body fat percentage ($r=0.805$, $p=0.005$), lean body mass (LBM; $r=0.675$, $p=0.032$), T-Test ($r=0.788$, $p=0.007$), vertical jump ($r= -0.953$, $p=0.003$), single-hand total reaction time ($r=0.857$, $p=0.014$), and multi-hand total reaction time ($r=0.781$, $p=0.038$). The correlations between anthropometrics and performance in the 300-yard shuttle are presented in the scatterplots below.

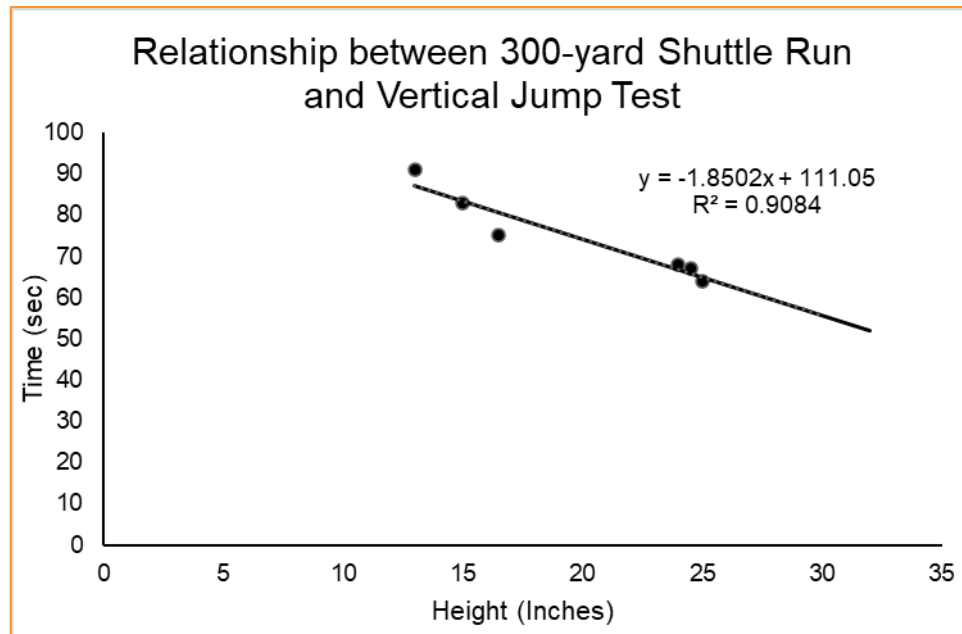


Figure 1. The Relationship between the 300-yard Shuttle and Vertical Jump in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with a vertical jump ($r = -0.953$, $p = 0.003$). This data suggests that the faster time in which participants ran the 300-yard shuttle, the higher their vertical jump would be.

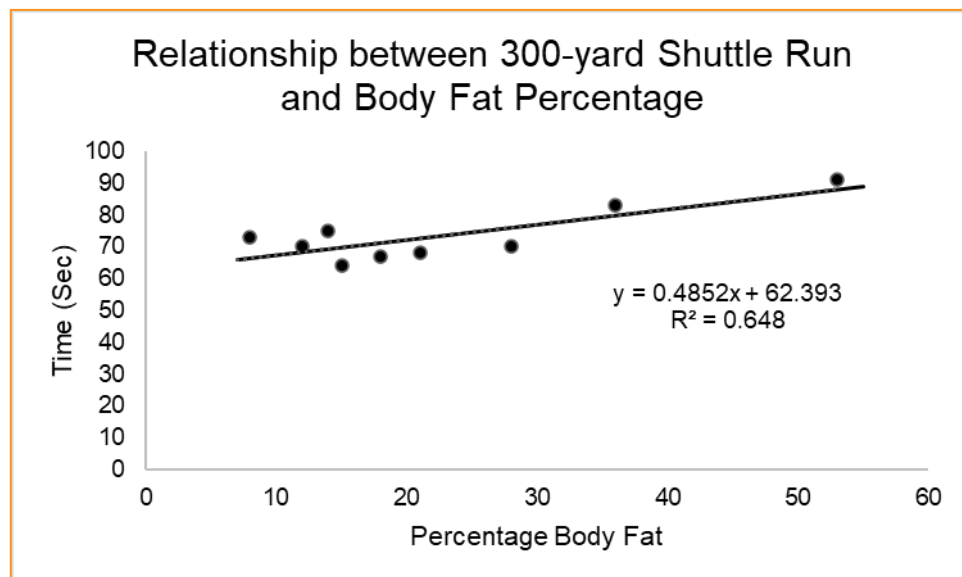


Figure 2. The Relationship between the 300-yard Shuttle and Body Fat Percentage in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with body fat percentage ($r = 0.805$, $p = 0.005$). This data suggests that the faster time in which participants ran the 300-yard shuttle, the lower their body fat percentage would be.

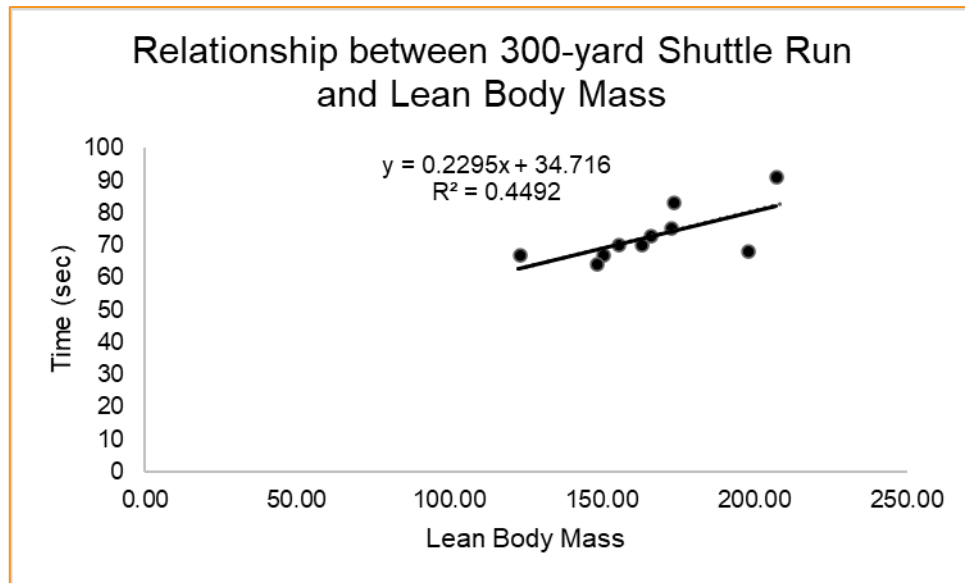


Figure 3. The Relationship between the 300-yard Shuttle and Lean Body Mass in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with lean body mass (LBM; $r=0.675$, $p=0.032$). This data suggests that the faster time in which participants ran the 300-yard shuttle, the higher their lean body mass would be.

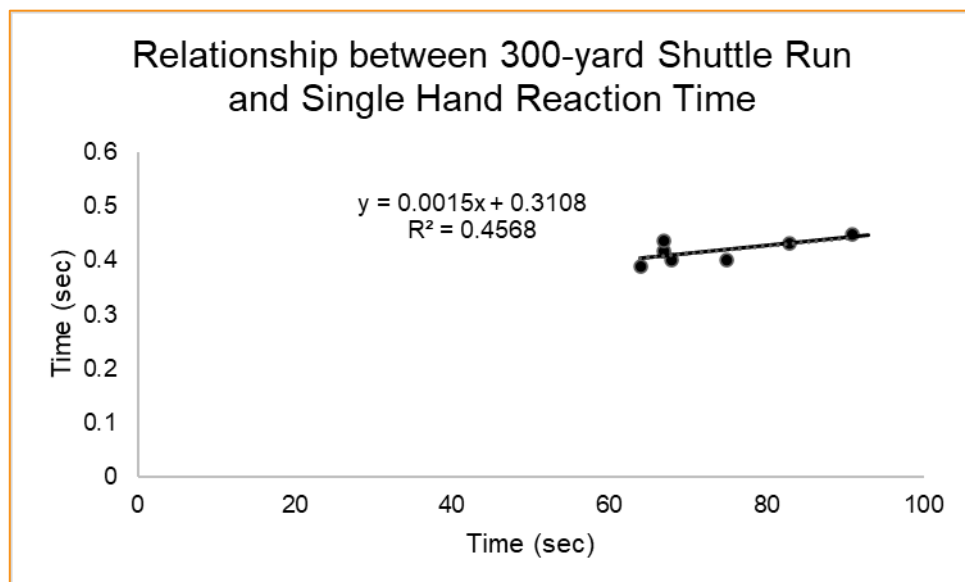


Figure 4. The Relationship between the 300-yard Shuttle and Single-hand Reaction Time in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with single-hand total reaction time ($r=0.857$, $p=0.014$). This data suggests that the faster time in which participants ran the 300-yard shuttle, the lower their single-hand reaction time would be (i.e., they would have faster reaction times).

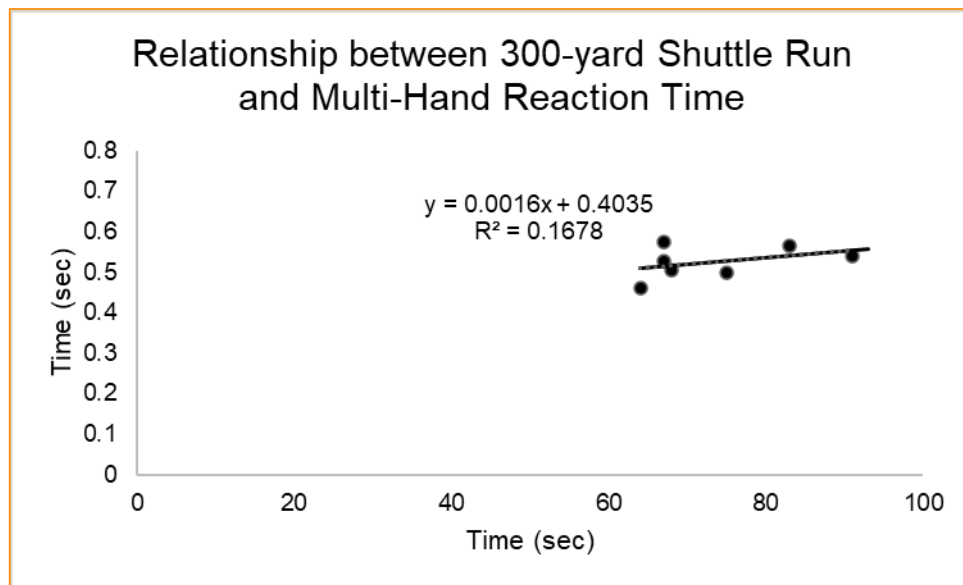


Figure 5. The Relationship between the 300-yard Shuttle and Multi-hand Reaction Time in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with multi-hand total reaction time ($r=0.781$, $p=0.038$). This data suggests that the faster time in which participants ran the 300-yard shuttle, the lower their multi-hand reaction time would be (i.e., they would have faster reaction times).

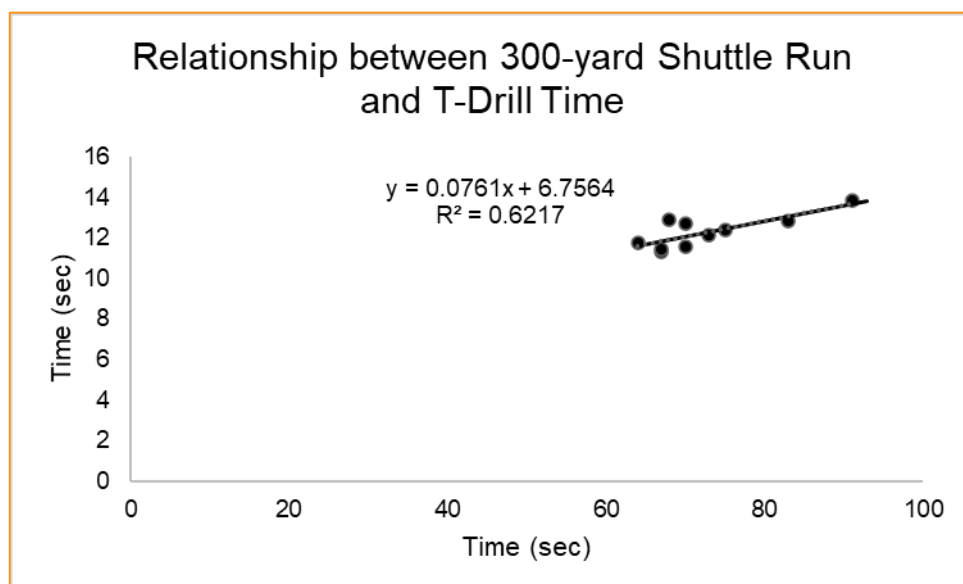


Figure 6. The relationship between the 300-yard Shuttle and the T-test in Collegiate Male Rodeo Athletes

Results show that the 300-yard shuttle had a significant relationship with T-Test ($r=0.788$, $p=0.007$). This data suggests that the faster participants ran the 300-yard shuttle, the faster their T-Drill time would be.

While previous studies have found a relationship between body fat percentage and 300-yard shuttle results (Collins et al., 2014), few, if any, have correlated to other performance tests in rodeo athletes. Therefore, the findings of this study are novel and unique in their predictive capabilities.

Discussion

As rodeo performance is a unique sport with limited literature explaining the athletic demands and the performance of its athletes, this article aimed to examine the relationship between anthropometric measurements and the physical fitness of rodeo athletes. A secondary objective was to contribute towards building a descriptive profile of collegiate rodeo athletes to better understand the sport and those that participate in it.

Descriptive data analysis revealed that the trap bar deadlift 1RM had a significant relationship with the bench press 1RM ($r=0.874$, $p=0.005$) and back squat 1RM ($r=0.938$, $p=0.002$). Interestingly, however, there was no correlation between any 1RM value and vertical jump height, lean body mass, or an anaerobic running test. This finding is particularly interesting, as recent scholars of rodeo athletes' physiology have hypothesized that the physical profiles of rodeo athletes would parallel athletes from anaerobic sports. Although the participants in this study are experienced rodeo athletes, most were categorized as novice lifters; because of a lack of experience performing resistance training programming, it is likely that 1RM performances were based on increased neuromuscular efficiencies (Costigan et al., 2015) – i.e., a 'learning effect.'

This study offers new and unique information about the modern rodeo athlete, which can help exercise science practitioners design more efficient training programs. The 300-yard shuttle is an athletic performance indicator of significant usefulness, especially in male rodeo athletes. Furthermore, some anthropometrics, such as lean body mass, are related to performance in athletes; this significance is recognized by professional teams who use the measurements as selection criteria for recruitment purposes (Brocherie et al., 2014; McGee & Burkett, 2003; Stone & Learning, 2013).

At the time of Myers and colleagues' study, no publication examined the exercise performance of collegiate rodeo athletes. To the best of the authors' knowledge, this line has not been a thorough extension since. A robust literature pool suggests that physiologic testing of athletes has demonstrated that those athletes who exhibit low aerobic capacity and high percent body fat have a higher incidence of fatigue and show decreased performance levels (Cano et al., 2022; Lukaski, 2017). This may ultimately be viewed as a predisposition to injury (Turnbull et al., 2017) since injury potential is inversely associated with the state of training (Diaz, 2013; Visaria et al., 2022).

While event-specific strength and conditioning protocols for rodeo have been subjectively prescribed (Wicklund et al., 2018), these protocols are highly dated, and incredible advancements in sports science and equipment have occurred since then. A modernized exercise prescription for the rodeo athlete would be highly valuable – especially one which includes adequate physiologic data (Kadel et al., 2016).

CONCLUSION

This study met the primary goal of describing the relationships between anthropometric measurements and the physical fitness of rodeo athletes by measuring their performance, particularly anaerobic power tests. The results of this study offer multifaceted returns. This study adds to the knowledge available on the modern rodeo athlete and illuminates some significant relationships and training considerations. Interestingly, the 300-yard shuttle is useful as a predictor of LBM and many athletic performance variables. Participants in this study exhibited a relationship between the 300-yard shuttle and nearly all performance tests (except for 1RM tests).

The data presented in this descriptive overview of rodeo athletes' physical profiles and anaerobic performance in field tests could serve as a foundational data set to measure the effectiveness of a sport-specific strength and conditioning program for the participants in this study. An extension of such a study could investigate the volume, type, and severity of injuries pre- and post-strength and conditioning program completion.

Further study is needed involving a longitudinal approach, a larger sample of subjects, and a more robust performance testing battery. Future studies could investigate the relationship between these descriptive data and ethnicity and amateur/professional status. In addition, a future study could measure the change and potential statistical significance as athletes age from year to year [i.e., freshman to sophomore to junior, etcetera]. Furthermore, future investigations could analyze the impact of a physical conditioning strength program on these physical characteristics and anaerobic performance. Finally, an extension of this line could investigate the occurrence and severity of

injuries to rodeo athletes to determine a relationship between injury and strength and conditioning program participation.

The authors acknowledge the number of participants is too small to make sweeping assumptions about exercise programming and a physical profile of collegiate rodeo athletes; this study - and its potential for further extrapolation and analysis - can offer some remediation to the significant lack of scientific literature available on collegiate rodeo.

AUTHOR CONTRIBUTIONS STATEMENT

The first author (CP) lead the writing of the manuscript. The second author (AW) developed the training program, coordinated the research lab, and collected data. The third author (JC) participated in data analysis. All three authors had a role in writing and revising the written manuscript.

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